REMOTE PROCESS CONTROL AND MONITORING BY USING TCP/IP

NURUL IZYAN BINTI AHMAD TARMIZI

UNIVERSITI MALAYSIA PAHANG

"I hereby acknowledge that the scope and quality of this report is qualified for the award of the Bachelor Degree of Electrical Engineering (Electronics)"

Signature : _____

Name : ROSMADI BIN ABDULLAH

Date : 17 NOVEMBER 2008

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This report is submitted as partial fulfillment of the requirements for the award of the Degree of Bachelor of Electrical Engineering (Electronics)

Faculty of Electrical & Electronics Engineering
Universiti Malaysia Pahang

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Signature : _____

Author : NURUL IZYAN BINTI AHMAD TARMIZI

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ABSTRACT

This project presents a practical approach to monitor and control the process in industries by computer using TCP/IP connection. Transmission Control Protocol (TCP) and the Internet Protocol (IP) are the protocols for communication on the Internet where a stream of data that is sent over the Internet is first broken down into packets by the TCP and IP is responsible for sending the packet to its destination along a route. The system contains two main parts that is a local digital controller and graphical user interface (GUI) application. The local digital controller which controls the system is implemented on a PIC18F4620 microcontroller. The graphical user interface (GUI) application by using visual basic makes the users easier to monitor and control the system when uses TCP/IP protocol. The user can monitor and control the process by using computer. Programming software also will be used to program this microcontroller. By using this TCP/IP on this project, a lot of advantages we can get such as the user can be at any place to monitor and control the system as long as they have computer along with the internet connection. It also can maintain the productivity and prevent losses of the product in industries.

ABSTRAK

Projek ini merupakan salah satu cara praktikal untuk mengawal dan memerhati proses yang dijalankan di dalam industri dengan menggunakan TCP/IP sebagai alat perhubungan. Protokol kawalan pindahan (TCP) dan protokol internet (IP) merupakan protokol komunikasi dimana data akan dihantar melalui TCP dalam bentuk paket dan IP akan menghantar paket data itu ke destinasi yang dikehendaki. Sistem ini mengandungi dua bahagian iaitu pengawal digital setempat dan antaramuka pengguna bergrafik (GUI). Pengawal digital setempat digunakan untuk mengawal system yang diaplikasikan kepada pengawal mikro PIC18F4620. Antaramuka pengguna bergrafik yang menggunakan visual basic memudahkan pengguna untuk memerhati dan mengawal proses apabila protokol TCP/IP digunakan. Pengguna boleh mengawal dan memerhati proses dengan hanya menggunakan komputer sahaja. Perisian pengaturcara akan digunakan untuk mengaturcara pengawal mikro ini. Terdapat pelbagai faedah yang kita boleh perolehi dengan menggunakan TCP/IP ini seperti pengguna boleh berada dimana sahaja untuk memerhati dan mengawal system selagi mereka mempunyai komputer dan internet. TCP/IP ini boleh mengekalkan produktiviti dan mengurangkan pengeluaran produk yang tidak elok di industri.

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LED	-	Light-Emitting Diode
PIC	-	Peripheral Interface Controller
PCB	-	Printed Circuit Board
LCD	-	Liquid Crystal Display
VCC	-	Supply voltage

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CHAPTER 1

INTRODUCTION

1.1 Background

The name TCP/IP refers to a suite of data communication protocols. The name is misleading because TCP and IP are only two of dozens of protocols that compose the suite. Its name comes from two of the more important protocols in the suite that is the Transmission Control Protocol (TCP) and the Internet Protocol (IP). They are the protocols for communication on the Internet. A stream of data that is sent over the Internet is first broken down into packets by the TCP. Data packets include the receiving computer's address, a sequence number, error correction information, and a small piece of data. IP is responsible for sending the packet to its destination along a route.

In 1969, Department of Defense (DoD) was initialized that TCP/IP originated out from the investigation research into networking protocols. Before that in 1968, the DoD Advanced Research Projects Agency (ARPA) began researching the network technology that is called packet switching. The TCP/IP protocols played an important role in the development of internet. In the early 1980s, the TCP/IP protocols were developed and became standard protocols for ARPANET in 1983.

1.1 Introduction to the project

Normally in a process plant, flows, pressures, levels and temperatures during a process need to be monitored so that there are no errors occurred to maintain productivity and prevent losses but it is dangerous for a worker to monitor these parameters directly from the process room. So, the TCP/IP is one way to avoid the hazardous for the workers and increase safety for them.

We also can maintain the desired state such processes that we need to keep constant at prescribed values such variables as flows, pressures, levels, temperatures and others which demands the design of automatic control systems for them.

The important aspects during this project are theoretical and practical aspects. The theoretical part gives scientific knowledge about the topic. The practical part allows the student to gain more understanding of the theoretical concept with develop a hardware.

This project is purposely designed to easier the users to monitor and control the process in industries by computer using TCP/IP connection. The users can be at any place to monitor and control the process as long as they have computer along with the internet connection. Besides that, it can save the cost from taking many employees and save time because the system can be monitored and control by one person only.

1.2 Objective

The objective of this project is to design and fabricate a system that can monitor and simultaneously can control devices in a system remotely using TCP/IP.

1.3 Scope of the project

i. To design a process control system in industry by using Peripheral Interface Controller (PIC).
ii. To design the graphical user interface (GUI) using Visual Basic.
iii. To integrate the GUI and hardware by using TCP/IP connection.

1.3 Report contents

In chapter 1, an introduction briefly describe preface of the project. It will clearly elaborate on how to remote process control and monitoring by using TCP/IP. This chapter generally described the main idea of project including objective and scope as guidance along manage the project.

In chapter 2, a literature review will elaborate early finding about the project. All information about past study and related equipments were analyzed and discussed carefully. Equipment on development this project is described in theory and technically.

In chapter 3, a methodology briefly describe the methods will use to run the project. All the method and tools used for run this project has been mention clearly here. This chapter also stated the whole project planning from the beginning till it has been completed. The project planning has been represented by a flow chart.

In chapter 4, the result and discussion of the project will be described. This is the important chapter, the results obtain from the PCB board whether it can run the device or not. The elaboration about whole project will discuss clearly and complete from early step to the end. The result gain and procedure the test conduct will be

discuss either it achieve the objective or not.

In chapter 5, a conclusion briefly described all the works and act that have been done before and summarized the finding and result.. In addition, suggestion that have value for future improvement or extension will list.

CHAPTER 2

LITERATURE REVIEW

2.1 TCP/IP

The name TCP/IP refers to a suite of data communication protocols. The protocols that make up the internet protocol suite know as TCP (Transmission Control Protocol) and IP (Internet Protocol). TCP/IP is design to hides the function of this layer from users. It is concerned with getting data across a specific type of physical network such as Ethernet.

The TCP/IP protocol suite consists of several interacting pieces of software including a data layer IP, ICMP, TCP, SNMP and others. The TCP/IP uses a layered networking structure. At the data layer, adjacent hosts and routers exchange link packets. At the IP layer, nodes decode IP packets within the link packet. Hosts use the protocol field to forward the encapsulated packet to an upper-layer protocol where the routers use the destination address and a routing algorithm to determine which interface to forward each packet on.

At the transport layer, TCP use the port and address fields to communicate with separate processes on one or more hosts. It also uses several mechanisms to ensure that the data is transferred reliably and efficiently. The application layer communicates with other application layers using TCP.

2.2 PIC18F4620 Microcontroller

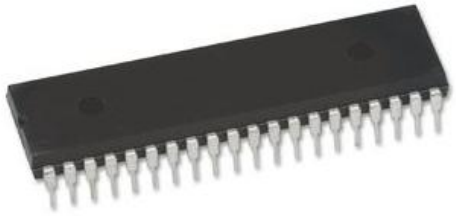

Figure 2.1: PIC18F4620 Microcontroller

2.2.1 Function Description

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Programmable Interface Controller" but shortly thereafter was renamed "Peripheral Interface Controller".

PICs are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

Special Microcontroller Features for PIC18F4620 are:

- C Compiler Optimized Architecture where it has optional extended instruction set designed to optimize re-entrant code.
- 100,000 Erase/Write Cycle Enhanced Flash Program Memory Typical
- 1,000,000 Erase/Write Cycle Data EEPROM Memory Typical

- Flash/Data EEPROM Retention: 100 Years Typical
- Self-Programmable under Software Control
- Priority Levels for Interrupts
- 8x8 Single-Cycle Hardware Multiplier
- Extended Watchdog Timer(WDT): Programmable period from 4 ms to 131s
- Single-supply 5V In-Circuit Serial Programming™ (ICSP™) via Two Pins
- Wide Operating Voltage Range: 2.0V to 5.5V

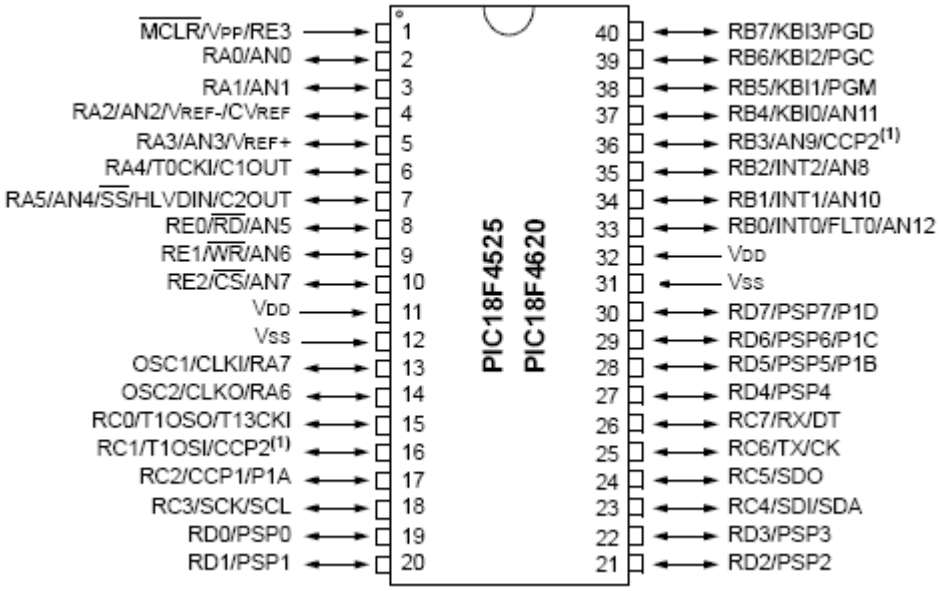

Figure 2.2: Pin Diagram of PIC18F4620

2.3 Graphical User Interface (GUI)

A graphical user interface or GUI is a type of user interface which allows people to interact with a computer and computer controlled devices. It presents graphical icons and visual indicator. The graphical icons usually used in conjunction

with text, labels or text navigation to fully represent the information and actions available to a user. GUI does not apply to other high-resolution types of interfaces that are non-generic such as video games or not restricted to flat screens like volumetric displays.

Designing the visual composition and temporal behavior of GUI is an important part of software application programming. Its goal is to enhance the efficiency and ease of use for the underlying logical design of a stored program, a design discipline known as usability. Techniques of user-centered design are used to ensure that the visual language introduced in the design is well tailored to the tasks it must perform.

The visible graphical interface features of an application are sometimes referred to as chrome. Larger visual indicator such as windows usually provides a frame or container for the main presentation content such as a web page, email message or drawing. Smaller ones usually act as a user-input tool.

A GUI may be designed for the rigorous requirements of a vertical market. This is known as an application specific graphical user interface. Examples of an application specific GUI are:

- Touch screen point of sale software used by wait staff in a busy restaurant
- Self-service checkouts used in a retail store
- Automated teller machines (ATM)
- Airline self-ticketing and check-in
- Information kiosks in a public space, like a train station or a museum
- Monitors or control screens in an embedded industrial application which employ a real time operating system (RTOS).

2.3.1 Visual Basic 6

Visual Basic 6 was used as GUI in this project. It designed to be easy to learn and use. The language not only allows programmers to create simple GUI applications but can also develop complex applications as well. Programming in visual basic is a combination of visually arranging components or controls on a form specifying attributes and actions of those components and writing additional lines of code for more functionality. Since default attributes and actions are defined for the components, a simple program can be created without the programmer having to write many lines of code. Performance problems were experienced by earlier versions but with faster computers and native code compilation this has become less of an issue

2.4 ENC28J60 Ethernet Controller

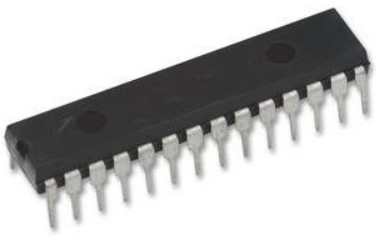

Figure 2.3: ENC28J60 Ethernet Controller

2.4.1 Function Description

ENC28J60 Ethernet controller is a standalone Ethernet controller with an industry standard peripheral interface (SPI). It is designed to serve as an Ethernet network interface for any microcontroller equipped with SPI. It meets all the specifications for IEEE 802.3 and incorporates a number of packet filtering schemes